REMARKS

Status

Claims 1-21 were originally filed. In response to a restriction requirement claims 15-21 have been canceled. Accordingly, it is claims 1-14 which are at issue.

The Office Action

In the Office Action mailed December 14, 2005, claims 1-14, all claims then at issue, were rejected. Claims 1-8, 11 and 13-14 were rejected under 35 U.S.C. §102 as being anticipated by U.S. Patent 6,274,461 of Guha. Claims 9 and 10 were rejected under 35 U.S.C. §103 over Guha '461 in view of U.S. Patent Application Publication 2003/0036090 of Patil. Claim 12 was rejected under 35 U.S.C. §103 as being unpatentable over Guha '461 in view of U.S. Patent 5,786,023 of Maxwell.

In addition, claims 6, 7, 13 and 14 were objected to on the grounds that the particular Markush language was confusing.

Applicant thanks the Examiner for the Office Action and for the thorough explanation of the basis of the rejections.

The Present Invention

Applicant will briefly recapitulate the principles of the present invention so as to better differentiate it from the cited prior art. The invention, as is specifically claimed, is directed to a method for the plasma deposition of a high quality layer of microcrystalline semiconductor material. As described in the specification, microcrystalline semiconductor materials have particular advantages in certain applications; however, the electrical quality of these materials is very dependent upon their morphology. In general, microcrystalline materials exhibiting columnar growth, large grain sizes, high defect grain boundaries and the like, often manifest poor electrical performance in semiconductor devices. The present invention recognizes that in a plasma deposition process in which

electromagnetic energy is used to decompose a process gas and deposit a semiconductor material, the degree of dilution of that process gas must be varied as the thickness of the deposited layer increases. As will be explained hereinbelow, the prior art has not recognized this fact, and does not show or suggest any deposition process in accord with the claims at issue.

The Rejections under 35 U.S.C. §102

It is the Examiner's position that claims 1-8, 11 and 13-14 are anticipated by U.S. Patent 6,274,461 of Guha. In formulating the rejection, the Examiner states in section 3 of the Office Action:

> As to claim 1, Guha et al. teaches at figures 1-2 a process for the plasma deposition of **layer of microcrystalline semiconductor material**, wherein a process gas which includes a precursor of the semiconductor material and a diluent is energized with electromagnetic energy so as to create a plasma therefrom, which plasma deposits a layer of **the microcrystalline semiconductor material** onto a substrate (see col. 2, lines 43-61), wherein the improvement comprises: varying the concentration of the diluent in the process gas as a function of the thickness of the **layer of microcrystalline semiconductor material** which has been deposited (see col. 6, lines 20-53). (Emphasis added.)

In formulating this rejection, the Examiner has misinterpreted the '461 patent, and such is evidenced by the specific passages referred to by the Examiner. The '461 patent is not directed to the preparation of a microcrystalline material. The '461 patent is specifically directed to the preparation of high quality amorphous semiconductor materials, and in that regard specifically teaches a deposition process optimized to **avoid the deposition of a microcrystalline semiconductor materia**l.

This is made very clear from the explicit language of the '461 patent. For example, at column 1, lines 54-59, the '461 patent specifically states the best photovoltaic devices are manufactured when the photogenerative material is amorphous. The '461 patent goes on to specifically teach away from the desirability of using microcrystalline materials in photovoltaic devices and in this regard at column 2, lines 9-16, states that open circuit voltage of a photovoltaic device decreases as the material

becomes microcrystalline, and further teaches that the presence of grain boundaries in a microcrystalline material adversely affects the performance of the photovoltaic device. As specifically proposed in the '461 patent, semiconductor materials for photovoltaic devices having optimum performance characteristics are prepared from material which is amorphous but is manufactured under a series of deposition parameters which are in the amorphous deposition regime but nearer to the threshold at which the deposition process begins to produce microcrystalline materials. As such, the '461 patent teaches (1) the deposition of amorphous materials and (2) the desirability of avoiding the deposition of microcrystalline materials. As such, the '461 patent specifically teaches away from the principles of the present invention, which invention is directed to methods for the preparation of microcrystalline semiconductor materials. This is made very clear in the passage referred to by the Examiner at column 2, lines 54-57, wherein it is specifically stated that the process of the '461 patent is carried out "so as to produce a relatively ordered amorphous material."

The '461 patent teaches that it is necessary to decrease the dilution of the process gas as an amorphous semiconductor layer is grown so as to keep that layer amorphous and prevent it from becoming microcrystalline. In this regard see column 6, lines 39-44. In contrast, the present invention operates to prepare a microcrystalline semiconductor layer and teaches that it is necessary to decrease the dilution of the process gas as the microcrystalline layer grows so as to maintain the deposition of a high quality microcrystalline layer.

Clearly, the teaching of the '461 patent and the teaching of the present invention are directly opposite. This evidences the fact that the two are directed to very different deposition processes. Specifically, the '461 patent shows the preparation of amorphous material and teaches control of the deposition process to avoid preparing microcrystalline materials, and further teaches that such control involves dilution of the process gas. In contrast, the present application is directed to the deposition of

high quality microcrystalline semiconductor materials and teaches control of process gas composition so as to maintain the high quality of the microcrystalline material.

The two bodies of teaching cover diametrically opposed technologies. Therefore, the '461 patent does not show or suggest the claimed principles of the present invention; and in fact, any teaching to be gleaned from the '461 patent is directly opposite, and away from, the principles of the present invention, since that patent teaches methods for **preventing microcrystalline semiconductor growth** while the present application teaches principles for **encouraging microcrystalline semiconductor growth**.

In view of the foregoing, Applicant respectfully submits that the presently claimed invention is neither shown nor suggested in the '461 patent, and the rejections under 35 U.S.C. §102, and any possible rejections under 35 U.S.C. §103, are inappropriate.

The Affidavit

Applicant submits herewith the affidavit of Dr. Chi C. Yang, one of the named inventors in the 6,274,461 patent. In his affidavit, Dr. Yang states that the '461 patent is directed to the preparation of amorphous material, and in that regard teaches control deposition parameters so as to avoid the formation of microcrystalline materials.

The Rejections under 35 U.S.C. §103

Claims 9, 10 and 12 were rejected under 35 U.S.C. §103 as being unpatentable over the '461 patent in view of published application U.S. 2003/0036090 or U.S. Patent 5,786,023. The '090 application and the '023 patent show specific features of certain dependent claims, and have been cited in combination with the '461 patent to support the Examiner's assertion that the presently claimed invention is obvious.

In view of the general inapplicability of the '461 patent, these rejections will fail. Accordingly, reconsideration and withdrawal thereof is respectfully requested.

The Objections to the Claims

Claims 6, 7, 13 and 14 were objected to on the grounds that the Markush language used therein was confusing. Applicant has hereby revised those claims in accord with the Examiner's suggestions, and this objection is now overcome.

Conclusion

In view of the foregoing, Applicant respectfully submits that this application is now in condition for allowance. Any questions, comments or suggestions which the Examiner may have should be directed to the undersigned attorney.

Respectfully submitted,

Ronald W. Citkowski
Registration No. 31,005
Gifford, Krass, Groh, Sprinkle,
Anderson & Citkowski, P.C.
2701 Troy Center Drive, Suite 330
P.O. Box 7021
Troy, MI 48007-7021
(248) 647-6000

Attorney for Applicant

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Janice Burkhardt
Janice BURKHARDT